CLAIMS

1. A pump assembly (100) for a three-dimensional printing system, comprising:

a plurality of pumping cylinders (101), each configured to encase at least one first piston (102);

at least one first actuator (103) coupled to each of the at least one first piston (102), wherein the at least one first actuator (103) is configured to displace the at least one first piston (102) between a first position and a second position, within a corresponding pumping cylinder of the plurality of pumping cylinders (101);

a plurality of valves (104), each associated with at least one of the plurality of pumping cylinders (101), wherein each of the plurality of valves (104) is defined with an inlet port (115) and an outlet port (116);

a primer arrangement (110) having at least one primer chamber (105); a print nozzle, wherein each of said plurality of valves (104) is configured to fluidly connect the corresponding pumping cylinder (101) with the at least one primer chamber (105) in the primer arrangement (110) and the print nozzle;

one or more sensors (106) associated with the at least one first actuator (103), wherein the one or more sensors (106) are configured to generate an input signal corresponding to a position of the at least one first piston (102) within each of the plurality of pumping cylinders (101);

and a control unit (130), communicatively coupled to each of the one or more sensors (106), wherein the control unit (130) is configured to selectively operate the inlet port (1 15) and the outlet port (116) of each of the plurality of valves (104), based on the input signal received from the one or more sensors (106), such that a pumping cycle is initiated in one pumping cylinder (101) of the plurality of pumping cylinders

(101), and, simultaneously a loading cycle is initiated in another pumping cylinder (204) of the plurality of pumping cylinders (101).

2. The pump assembly (100) as claimed in claim 1, wherein the primer arrangement (110) comprising:

at least one primer chamber (105) configured to hold print material, wherein the at least one primer chamber (105) is in fluid communication with each of the plurality of pumping cylinders (101);

and a second piston (107) disposed in the at least one primer chamber (105), wherein the second piston (107) is coupled to a second actuator (108) and is configured to reciprocate, to displace the print material from the at least one primer chamber (105) into the corresponding pumping cylinder (101) during loading cycle.

3. The pump assembly (100) as claimed in claims 1 and 2, wherein the primer arrangement (110) comprises a plurality of guiding pillars (109) oriented vertically and, the plurality of guiding pillars (109) is configured to guide reciprocatory movement of the second piston (107).

4. The pump assembly (100) as claimed in claim 1, wherein the at least one first actuator (103) and the second actuator (108) is one of a hydraulic actuator, an electrical actuator and a pneumatic actuator.

5. The pump assembly (100) as claimed in claim 1, wherein the loading cycle corresponds to flow of a print material from the at least one primer chamber (105) into the corresponding pumping cylinder (101) of the plurality of pumping cylinders (101).

6. The pump assembly (100) as claimed in claim 1, wherein the pumping cycle corresponds to flow of pressurized print material from the corresponding pumping cylinder (101) of the plurality of pumping cylinders (101) into the print nozzle .

7. The pump assembly (100) as claimed in claim 1, comprises a nozzle (121) coupled to an end of each of the plurality of pumping cylinders (101), wherein the nozzle (121) is configured to guide the print material flowing out of the corresponding pumping cylinder (101) of the plurality of pumping cylinders (101).

8. The pump assembly (100) as claimed in claim 1, comprises a first passage (111) for interconnecting inlet ports (115) of each of the plurality of valves (104) with the at least one primer chamber (105).

9. The pump assembly (100) as claimed in claim 1, comprises a second passage (112) for interconnecting outlet port (116) of each of the plurality of valves (104) with the print nozzle .

10. The pump assembly (100) as claimed in claim 1, wherein each of the plurality of valves (104) comprises:

a hollow tube (113) defined with the inlet port (115) and the outlet port (116); and

a selection rod (114) disposed within the hollow tube (113) and defined with a first port (117) and a second port (118), wherein the selection rod (114) is configured

to displace to selectively align the first port (117) and the second port (118) with the inlet port (115) and the outlet port (116).

11. The pump assembly (100) as claimed in claim 1, wherein each of the plurality of valves (104) comprises a drain port (119), to facilitate cleaning of each of the plurality of pumping cylinders (101).

12. The pump assembly (100) as claimed in claim 1, comprises at least one non-return valve (127) disposed between each of the plurality of valves (104) and the at least one primer chamber (105), to selectively allow and stop flow of the print material into each of the plurality of pumping cylinders (101).

13. The pump assembly (100) as claimed in claim 1, wherein the control unit (130) is configured to generate a signal to operate the inlet port (115) of the valve (104) associated with one pumping cylinder (101) of the plurality of pumping cylinders (101), to enable the loading cycle of one pumping cylinder (101) of the plurality of pumping cylinders (101), based on the input signal generated by the one or more sensors (106) which correspond to the first position of the at least one first piston (102).

14. The pump assembly (100) as claimed in claim 1, wherein the control unit (130) is configured to generate a signal to operate the outlet port (116) of the valve (104) associated with one pumping cylinder (101) of the plurality of pumping cylinders (101) to enable pumping cycle of one pumping cylinder (101), based on the input signal generated by the one or more sensors (106) which correspond to completion of the loading cycle in one pumping cylinder (101) of the plurality of pumping cylinders (101).

15. A pumping system (200) for a three-dimensional printing system, comprising:

a primer arrangement (110) comprising at least one primer chamber (105) configured to hold print material and a second piston (107) disposed in the at least one primer chamber (105), wherein the second piston (107) is coupled to a second actuator (108);

a pump assembly (100) in fluid communication with the primer arrangement (110);

the pump assembly (100) comprises a plurality of pumping cylinders (101), configured to encase at least one first piston (102) coupled to at least one first actuator (103), wherein each of the of the pumping cylinders (101) of the plurality of pumping cylinders (101) is associated with at least one primer chamber (105);

a print nozzle;

a plurality of valves (104), each associated with at least one of the plurality of pumping cylinders (101), wherein each of the plurality of valves (104) comprises an inlet port (115) and an outlet port (116) for fluidly connecting the corresponding pumping cylinder (101) with the at least one primer chamber (105) and the print nozzle ;

one or more sensors (106) associated with the at least one first actuator (103) and the second actuator (108), wherein the one or more sensors (106) are configured to generate an input signal corresponding to a position of the at least one first piston (102) within each of the plurality of pumping cylinders (101) and position of the second piston (107) in the at least one primer chamber (105); and

a control unit (130), communicatively coupled to each of the one or more sensors (106), wherein the control unit (130) is configured to selectively operate the inlet port (115) and the outlet port (116) of each of the plurality of valves (104), based

on input signal received from the one or more sensors (106), such that a pumping cycle is initiated in one pumping cylinder (101) of the plurality of pumping cylinders (101), and simultaneously a loading cycle is initiated in another pumping cylinder (101) of the plurality of pumping cylinders (101).

16. The pumping system (200) as claimed in claim 15, wherein the at least one first actuator (103) and the second actuator (108) is one of a hydraulic actuator, an electrical actuator and a pneumatic actuator.

17. The pumping system (200) as claimed in claim 15, wherein the loading cycle corresponds to flow of a print material from at least one primer chamber (105) into the corresponding pumping cylinder (101) of the plurality of pumping cylinders (101).

18. The pumping system (200) as claimed in claim 15, wherein the pumping cycle corresponds to flow of pressurized print material from the corresponding pumping cylinder (101) of the plurality of pumping cylinders (101) into the print nozzle of the three-dimensional printing system.